

Appln. No.: 09/431,201
Amendment Dated December 5, 2003
Reply to Office Action of September 29, 2003

YAO-4308US

Amendments to the Claims: This listing of claims will replace all prior versions, and listings, of claims in the application

Listing of Claims:

1. (Previously Presented) A piezoelectric loudspeaker comprising:
 - a piezoelectric vibrator including a diaphragm and a piezoelectric member provided on at least one face of the diaphragm, the diaphragm being vibrated by the piezoelectric member;
 - a frame for supporting the piezoelectric vibrator; and
 - a visco-elastic member provided on at least one face of the piezoelectric vibrator,
 - the visco-elastic member being disposed in a substantial center of the piezoelectric vibrator,
 - the visco-elastic member having a bottom face area which accounts for about 11% to about 80% of a bottom face area of the diaphragm,
 - the visco-elastic member comprising first and second visco-elastic members provided on opposite sides of the piezoelectric vibrator, and
 - the first and second visco-elastic members comprising different materials or different shapes.
2. (Previously Presented) A piezoelectric loudspeaker comprising:
 - a piezoelectric vibrator including a diaphragm and a piezoelectric member provided on at least one face of the diaphragm, the diaphragm being vibrated by the piezoelectric member;
 - a frame for supporting the piezoelectric vibrator; and
 - a visco-elastic member provided on at least one face of the piezoelectric vibrator,
 - the visco-elastic member being disposed in a substantial center of the piezoelectric vibrator,

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the visco-elastic member having a bottom face area which accounts for about 11% to about 80% of a bottom face area of the diaphragm,

the visco-elastic member including two or more visco-elastic members stacked on top of each other, and

the two or more visco-elastic members comprising different materials or different shapes.

3. (Cancelled)

4. (Cancelled)

5. (Previously Presented) A piezoelectric loudspeaker comprising:

a piezoelectric vibrator including a diaphragm and a piezoelectric member provided on at least one face of the diaphragm, the diaphragm being vibrated by the piezoelectric member;

a frame for supporting the piezoelectric vibrator; and

a visco-elastic member provided on at least one face of the piezoelectric vibrator,

the visco-elastic member being disposed in a substantial center of the piezoelectric vibrator,

the visco-elastic member having a bottom face area which accounts for about 11% to about 80% of a bottom face area of the diaphragm,

the visco-elastic member comprising two or more visco-elastic members having mutually different values in at least one of specific gravity, Young's modulus, and internal loss, and

the two or more visco-elastic members are disposed in a concentric manner.

6. (Original) A piezoelectric loudspeaker according to claim 1, wherein a rigid member is provided on the visco-elastic member, the rigid member having a specific gravity which is larger than a specific gravity of the visco-elastic member.

7. (Previously Presented) A piezoelectric loudspeaker comprising:

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a piezoelectric vibrator including a diaphragm and a piezoelectric member provided on at least one face of the diaphragm, the diaphragm being vibrated by the piezoelectric member;

a frame for supporting the piezoelectric vibrator; and

a visco-elastic member provided on at least one face of the piezoelectric vibrator,

the visco-elastic member being disposed in a substantial center of the piezoelectric vibrator,

the visco-elastic member having a bottom face area which accounts for about 11% to about 80% of a bottom face area of the diaphragm, and

the piezoelectric vibrator having at least one aperture, the at least one aperture being at least partially filled by the visco-elastic member.

8. (Previously Presented) A piezoelectric loudspeaker comprising:

a piezoelectric vibrator including a diaphragm and a piezoelectric member provided on at least one face of the diaphragm, the diaphragm being vibrated by the piezoelectric member;

a frame for supporting the piezoelectric vibrator; and

a visco-elastic member provided on at least one face of the piezoelectric vibrator,

the visco-elastic member being disposed in a substantial center of the piezoelectric vibrator,

the visco-elastic member having a bottom face area which accounts for about 11% to about 80% of a bottom face area of the diaphragm,

the frame having a horn-like configuration including an opening, the opening having a gradually increasing cross-sectional area away from the piezoelectric vibrator and toward a final opening at which soundwaves are emitted, and

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the visco-elastic member having a conical configuration having a gradually decreasing cross-sectional area away from the piezoelectric vibrator and toward the final opening.

9. (Original) A piezoelectric loudspeaker according to claim 1 further comprising an element provided in a central portion of the visco-elastic member, at least one of specific gravity and elastic modulus of the element being larger than specific gravity and/or elastic modulus of the visco-elastic member.

10. (Previously Presented) A piezoelectric loudspeaker comprising:

a piezoelectric vibrator including a diaphragm and a piezoelectric member provided on at least one face of the diaphragm, the diaphragm being vibrated by the piezoelectric member;

a frame for supporting the piezoelectric vibrator; and

a visco-elastic member provided on at least one face of the piezoelectric vibrator,

the visco-elastic member being disposed in a substantial center of the piezoelectric vibrator,

the visco-elastic member having a bottom face area which accounts for about 11% to about 80% of a bottom face area of the diaphragm,

the visco-elastic member including notches in at least one portion thereof.

11.-17. (Cancelled)

18. (Previously Presented) A piezoelectric loudspeaker comprising:

a voltage applying means for applying a plurality of voltages;

a piezoelectric vibrator including a diaphragm and a plurality of piezoelectric members provided on at least one face of the diaphragm, the diaphragm being vibrated by the plurality of piezoelectric members;

a frame for supporting the piezoelectric vibrator;

wherein at least two of the plurality of piezoelectric members have a different voltage applied thereto from the voltage applying means; and

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an electrically resistant element for interconnecting at least two of the plurality of piezoelectric members.

19. (Previously Presented) A piezoelectric loudspeaker comprising:

a piezoelectric vibrator including a diaphragm and a piezoelectric member provided on at least one face of the diaphragm, the diaphragm being vibrated by the piezoelectric member;

a frame for supporting the piezoelectric vibrator;

a visco-elastic member provided on at least one face of the piezoelectric vibrator, the visco-elastic member being disposed in a substantial center of the piezoelectric vibrator, and the visco-elastic member having a bottom face area which accounts for about 11% to about 80% of a bottom face area of the diaphragm; and

a plate for connecting at least one said visco-elastic member to the frame so as to damp unwanted vibration of the piezoelectric vibrator, an enclosed space being formed by the plate, the frame, and the diaphragm.

20. (Original) A piezoelectric loudspeaker according to claim 19, wherein the plate has at least through-hole.

21. (Original) A piezoelectric loudspeaker according to claim 19, wherein the visco-elastic member includes a conductive portion which is in electrical contact with the piezoelectric vibrator, and an electrical input is applied to the conductive portion.

22. (Original) A piezoelectric loudspeaker according to claim 1 further comprising a lead wire for applying an electric input to the piezoelectric member, wherein the piezoelectric vibrator has at least one through-hole through which the lead wire is coupled to the piezoelectric member.

23. (Original) A piezoelectric loudspeaker according to claim 1 further comprising a cover for protecting at least one said visco-elastic member and the piezoelectric vibrator.

24. (Original) A piezoelectric loudspeaker according to claim 23 further comprising a conductive terminal for applying an electrical input to the piezoelectric member, the conductive terminal being provided within the cover.

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25. (Cancelled)

26. (Original) A piezoelectric loudspeaker according to claim 1,

wherein the frame includes a conductive portion which is in electrical contact with the piezoelectric vibrator, and an electrical input is applied to the conductive portion.

27. (Previously Presented) A piezoelectric loudspeaker comprising:

a piezoelectric vibrator including a diaphragm and a piezoelectric member provided on at least one face of the diaphragm, the diaphragm being vibrated by the piezoelectric member;

a frame for supporting the piezoelectric vibrator; and

a visco-elastic member provided on at least one face of the piezoelectric vibrator,

the visco-elastic member being disposed in a substantial center of the piezoelectric vibrator,

the visco-elastic member having a bottom face area which accounts for about 11% to about 80% of a bottom face area of the diaphragm, and

the visco-elastic member having a conical configuration having a gradually decreasing cross-sectional area away from the piezoelectric vibrator and toward a final opening.